PATENT SPECIFICATION

Application Date: Dec. 19, 1921. No. 34,148/21. **191,268**

Complete Accepted: Jan. 11, 1923.

COMPLETE SPECIFICATION.

Improvements in or relating to Driving Gear for Motor Driven Vehicles.

(A communication from PERFECTO GEAR DIFFERENTIAL CO., a corporation of the State of Washington, United States of America, of Bellingham, Whatcom County, Washington, United States of America.)

I, JOSEPH SUTTON WITHERS, British subject, of the Firm of J. S. Withers & Spooner, Chartered Patent Agents, of Staple House, 51—52, Chancery Lane, in the County of London, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention relates to direction and speed changing gearing for use in motor driven vehicles; more particularly, it relates to improvements in the speed changing and driving mechanism of the kind disclosed in my prior British Patent No. 172,503, the principal object of the present invention being to provide additional mechanism, in connection with that disclosed in the above mentioned patent, whereby a reverse speed may be obtained without reversing the direction of the master gear.

More specifically stated, it is the object of the present invention to provide, in connection with the planetary gear system and driving gearing disclosed in the above mentioned patent, mechanism for obtaining a reverse drive and a slower forward drive than is possible in the patented construction; this mechanism to comprise another ring gear mounted to turn with the original external ring gear and master gear, and gears, formed about the opposite ends of a sleeve that is shiftable along a non-movable shaft, and whereby upon proper shifting of the sleeve, different speeds of rotation may be imparted to the central gear of the original planetary system to effect the reverse drive or the slow forward speed as above stated.

The invention is illustrated, by way of example, in the accompanying drawings, wherein:—

Figure 1 is a view of a gearing construction embodied by the present invention, the upper portion of the mechanism being shown in vertical section while the lower portion is shown, for the greater part, in elevation.

Figure 2 is a transverse section, at a reduced scale, taken on the line 2—2 in Figure 1.

Figure 3 is a sectional view taken transversely of the mechanism on the line 3—3 in Figure 1.

Figure 4 is a transverse sectional view on the line 4—4 in Figure 1, illustrating the shifting means for the locking gear sleeve and the direction changing gears.

Figure 5 is an elevation and sectional view of parts of the present mechanism, showing the shiftable gears in position for imparting slow, forward driving.

Referring more in detail to the several views of the drawings.

1 and 2 designate the inner ends of differential shafts, which may comprise the shafts of an automobile rear axle. These shafts have their adjacent ends connected and driven by means of a differential mechanism of a standard construction consisting of two oppositely mounted bevel gears 3 and 4 that are keyed respectively onto the ends of the shafts 1 and 2, and intermediate bevel gears 5 which are revoluble on shafts 6 carried by a frame or casing 7 and which mesh simultaneously with the gears 3 and 4.

In the preferred construction, the frame 7 comprises two complemental sections, each having peripheral recesses which cooperate with recesses in the other member to form mountings for the shafts 6, and having bearing sleeves 8 at the outer sides thereof that are revoluble upon extended bearing portions of the gears 3 and 4 whereby the frame is supported in position.

Rigidly fixed within and extending laterally from the frame 7 at one side, is a series of journal pins 10 upon which

gear pinions 11 are mounted; these pinions, of which there are three, being the intermediate gears of a planetary gear system.

An internal ring gear 12 is the master gear of the planetary system and 13 designates the rotor or driving gear of the whole system; the two gears 12 and 13 being integrally cast and are secured between supporting webs 15 and 16 by means of a plurality of bolts 17 so that they may revolve concentrically about the shafts 1 and 2. The webs 15 and 16 together forming a housing enclosing the two gear systems are provided respectively with bearing sleeves 18 and 19 which are revolubly contained within anti-friction bearings 20 supported by and within the differential housing at opposite sides of the differential gearing, on brackets 28 and 29.

22 designates the inner, or central gear of the planetary system and this is formed integral with and at the inner end of a sleeve 23 that is adapted to turn freely upon and is longitudinally shiftable upon the axle 1. The outer end of the sleeve 23 is contained within a sleeve 24, which is keyed thereto and which in turn is provided at its inner end with a control gear 25, the teeth of which are, by shifting of the sleeve 23, adapted to be disengaged from or meshed with those of an internally toothed ring 26 which is fixed within the differential housing on the bracket 28. Also, mounted on the outer ends of the pins 10 is an internally toothed ring 27 which is adapted to receive the gear 22 as the sleeve 23 is shifted longitudinally on the axle.

The various gears are so arranged that when the control gear 25 is in mesh with the teeth of the ring 26, the gear 22 will be in mesh with the pinions 11 and entirely disengaged from the teeth of the ring 27, also, when the gear 22 is moved into mesh with the ring 27, the control gear 25 will be free from the ring 26. In the position in which the sleeve 23 is shown in Figure 1, the gears 22 and 25 are in neutral position that being the position they assume when they are not locked to either of the ring gears 26 or 27, which leaves the sleeve free to rotate.

Considering the mechanism as so far described, it will be seen that by shifting the sleeve 23 inwardly to such position that teeth of the control gear 25 mesh with the teeth of the fixed ring 26 and the gear 22 is in mesh only with the pinions 11, the sleeve is held against rotation and consequently, when the mechanism is driven, the rotor gear 13 and the axles will be rotated at different speeds; the latter being slower than the former according to the proportion or size of the gears. If, however, the sleeve 23 is shifted so as to disengage the teeth of the control gear 25 and interlock the teeth of the gear 22 simultaneously with the teeth of the pinions 11 and teeth of the ring 27 the pinions will be held against rotation so that the casing 7 will be locked relative to and will revolve with the rotor gear and the axles will be driven directly at what may be termed their high speed.

The above described operations are for forward driving only, as disclosed in my former patent; the present invention, however, resides in the construction of mechanism whereby a reverse drive and an additional slower, forward speed are provided. This comprises mechanism as follows:

Cast integral with the web member 16 is a laterally extending, annular flange 30 which projects in the direction of the axle 1 and co-axially therewith. This flange has an internally toothed gear surface 31 which serves as the internal ring gear of a gear system wherein the control gear wheel 25, of smaller diameter than the gear 22, on the sleeve 24 serves as the central gear and a gear wheel 32 formed about one end of a sleeve 33 that is slidable upon a countershaft 34 fixed within the housing parallel to the shaft 1, serves as an intermediate or countershaft gear.

Assuming that the parts are in the position as shown in Figure 1, and the rotor gear 13 is driven forwardly, the gear 31 turns therewith and this causes rotation of the various gears in the directions indicated by the arrows placed thereon in Figures 2 and 3 of the drawings. Since the countershaft gear wheel 32 is smaller than the internal gear 31, it travels at a faster angular speed, driving the control gear wheel 25 which revolves the sleeve 23 and gear 22 in the direction of the arrows. It will be noted that the gear wheel 22 is revolving now at a greater peripheral speed and in the opposite direction to that of the master gear 12, consequently the pinions 11 and the frame 7, whereby they are supported, are caused to travel bodily in the direction of rotation of the sleeve and thereby cause reverse turning of the axles 1 and 2 although the rotor gear is turning in the same direction as for forward driving.

To provide for another forward driving speed in addition to those previously disclosed, I have provided, at the outer end of the sleeve 33, a small gear wheel 35 which is adapted to be moved, by outward shifting of the sleeve 33, into mesh with a relatively large control gear 36 formed

about the outer end of the sleeve 24. In the construction, the distances between the gears 25 and 36 and the gears 32 and 35 are such, and the gear surface 31 is so located with respect to the gears 25 and 32 that, when the sleeve 23 is in neutral position, the sleeve 33 may be shifted outwardly to a neutral position as shown in dotted lines, so that there is no driving connection between the gears 31 and sleeve 23, or may be shifted farther to provide a driving connection through the intermediacy of the gear 32, sleeve 33, and gears 35 and 36. This latter connection will cause rotation of the gear 22 at a slower speed than that of the master gear 12 and in the opposite direction which effects slow forward driving of the axles. This speed depends, however, on the relative proportions of the gears used in the connection, and it is necessary that the proportions be such that the peripheral speed of rotation of the sleeve 23 in reverse direction will be less than that of the ring gear 12 in a forward direction, so that the gear casing 7 will rotate forwardly.

The preferred means for shifting the sleeve 23 to obtain the changes of speed through the first described planetary system, comprising a shifting yoke 40 mounted within the axle housing upon a vertical, turning shaft 41. The yoke extends about the sleeve 24 and has pins 42 directed inwardly therefrom that project within an annular groove between ribs 43 about the outer end portion of the sleeve. At its outer end the shaft 41 has a crank lever 44 fixed thereto to which an actuating rod 45 is attached. Likewise the sleeve 33 is shifted by means of a yoke 46 fixed to a vertical shaft 47 which is mounted within a bracket 48 within the housing and at its outer end has a crank 49 fixed thereto to which an actuating rod 50 is attached. The rods may extend to a point adjacent the drivers seat of the vehicle wherein the device is used and may be operated by any suitable lever mechanism.

Mechanism of the present character could be used in all motor vehicles of the ordinary types, and in such case the rotor gear 13 would be driven by means of a gear 52 at the end of the power shaft 53, Fig. 3, which would extend directly from the engine.

It is apparent that this construction will entirely eliminate the transmission gearing as at present used in motor vehicles and provides for either forward or reverse driving of the axles without changing the direction of rotation of the power shaft.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A driving gear of the kind referred to, in which means are provided for optionally locking the inner gear of the planetary system to turn with the differential casing, or to hold it against turning or to revolve it relatively to the master gear of the planetary system at a higher or a lower speed in the opposite direction.

2. A driving gear according to Claim 1, comprising a control gear mounted for rotation with the inner gear of the planetary system, and a ring gear mounted for rotation with the master gear of the planetary system.

3. A driving gear according to Claim 2, having means to effect a driving connection between the control gear and the ring gear.

4. A driving gear according to Claim 3, comprising a gear mounted on a countershaft and adapted to be moved into or out of mesh with the ring gear and the control gear.

5. A driving gear according to any of the preceding Claims 2 to 4, having fixed means adapted to engage with the control gear to hold the inner gear of the planetary system from rotating, and means to move the said control gear into and out of engagement with the said fixed means.

6. A driving gear according to any of the preceding Claims 2 to 5, comprising a second control gear mounted for rotation with the inner gear of the planetary system, and a second countershaft gear driven by the ring gear, the countershaft gears being adapted to be moved into or out of mesh with the control gears.

7. A driving gear according to Claim 4 or 5, in which the gear on the countershaft and in mesh with the ring gear is normally idle and shiftable to effect an operative connection with the control gear when the latter is in neutral position, to effect reverse rotation.

8. A driving gear of the kind referred to, substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 19th day of December, 1921.

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Agents for the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1930.

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1.

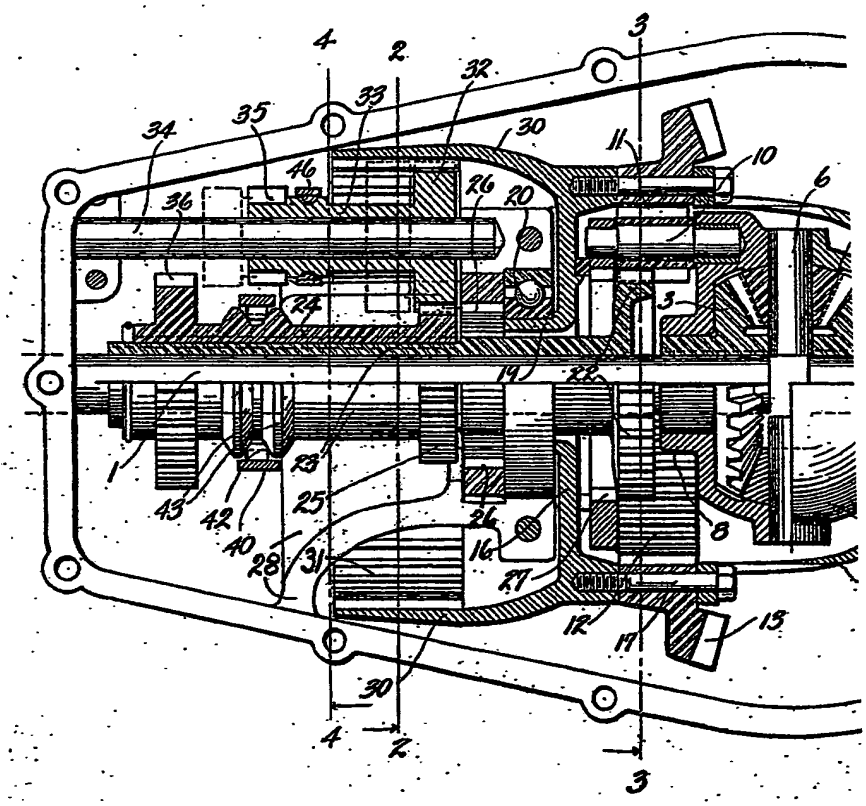


Fig. 2.

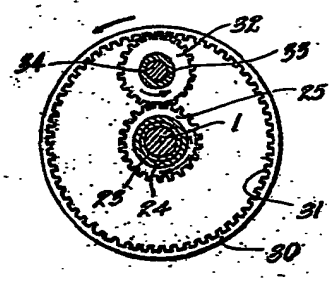


Fig. 3.

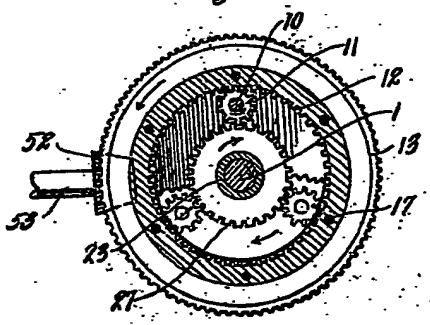


Fig. 4.

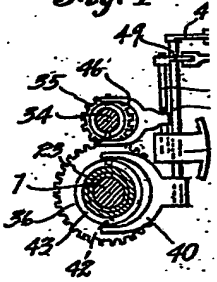


Fig. 1.

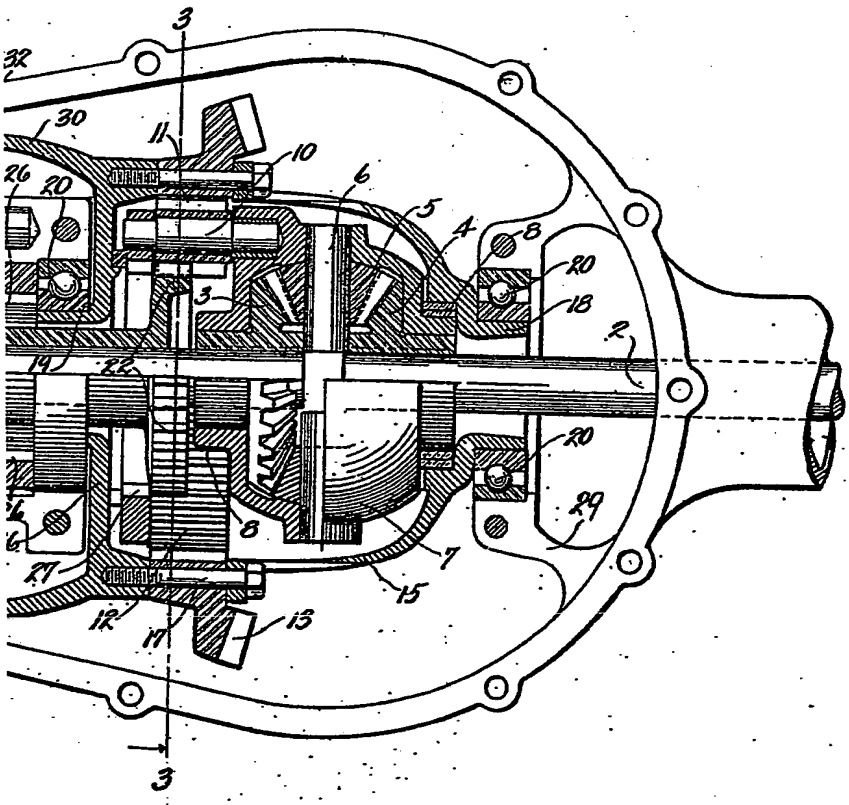


Fig. 4

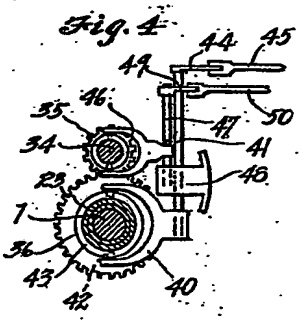
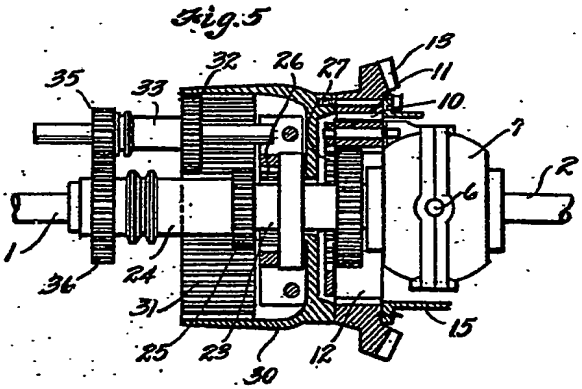


Fig. 5



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191,268 COMPLETE SPECIFICATION

1 SHEET

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1.

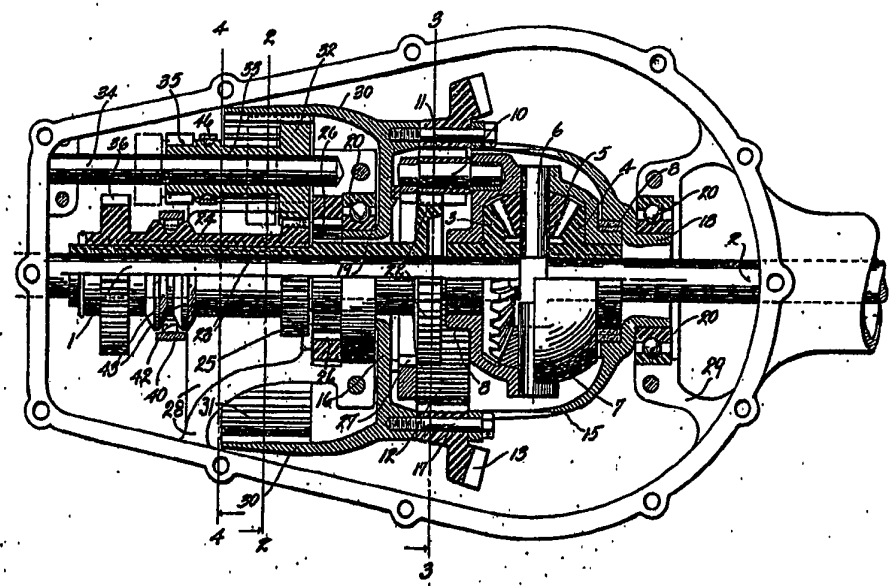


Fig. 2.

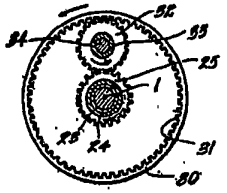


Fig. 3.

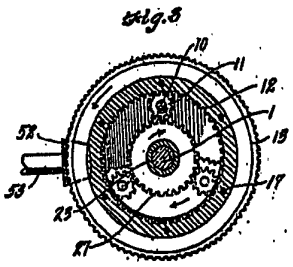


Fig. 4.

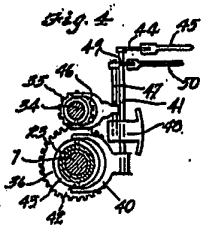
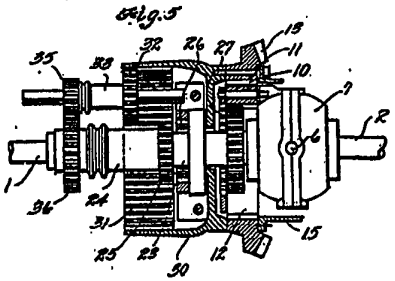


Fig. 5.



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